

REMARKS

Entry of the foregoing, reexamination and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

As correctly noted in the Office Action Summary, claims 16-23 and 27-29 were pending. By the present response, claims 16-23 and 27-28 have been amended, and claim 29 has been canceled. Thus, upon entry of the present response, claims 16-23 and 27-28 are pending and await further consideration on the merits.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: page 2, lines 20-23; page 3, lines 22-26 and 33-34; page 7, line 36 - page 8, line 5; page 8, lines 12-20; and page 11, lines 7-15.

CLAIM REJECTIONS UNDER 35 U.S.C. §§102/103

Claims 16-22 and 29 stand rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 7,022,776 to Bastiaens et al. (hereafter "*Bastiaens et al.*") on the grounds set forth in the Official Action.

The present invention is directed to a process for making a composition having good mechanical properties, such as good impact strength, as well as good paintability using an electrostatic paint deposition process, especially at high temperatures. The composition formed according to the process of the present invention includes a continuous thermoplastic matrix phase, and a distinct

discontinuous phase dispersed in the matrix. An example of this form of microstructure is illustrated in the scanning electron microscope (SEM) image appended hereto as Exhibit A.

A process performed according to the principles of the present invention is set forth in amended claim 23. Amended claim 23 recites:

23. *A process for producing a composition comprising:
a continuous thermoplastic matrix consisting of a polyamide, a copolyamide, a blend of polyamides, or a blend of copolyamides; and
a discontinuous phase dispersed in the matrix comprising at least one impact modifier, said discontinuous phase containing at least one electrically conductive filler in an amount sufficient to provide the composition with a level of conductivity suitable for painting by a electrostatic technique;
the process comprising the steps of:
a) blending the at least one impact modifier with the at least one electrically conductive filler, so as to obtain a masterbatch; and
b) blending the masterbatch obtained in step a) with the thermoplastic matrix.*

As evident from the above, claim 23 is directed to a process of forming a composition comprising blending "a thermoplastic matrix consisting of a polyamide, a copolyamide, a blend of polyamides, or a blend of copolyamides." By contrast, *Bastiaens et al.* is directed to a composition having a thermoplastic matrix composed of a polyphenylene ether copolymer/polyamide blend. Therefore, *Bastiaens et al.* clearly fails to disclose a process of forming a composition having the thermoplastic matrix as set forth in newly presented claim 29.

The process defined by claim 29 also requires forming a composition with at least one electrically conductive filler contained within a discontinuous dispersed phase distinct from the matrix.

Providing the electrically conductive fillers within the dispersed phase as opposed to providing the fillers in bulk into the matrix provides significant advantages over the prior art. For example, as discussed on pages 2-3 of the present specification, the composition formed according to the process of the present invention makes it possible to effectively disperse the fillers within a polyamide-matrix based composition, limits sheer induced structural rupture of the final plastic parts, provides the material with a lower melt viscosity, results in plastic parts having a linear thermal expansion coefficient, provides plastic parts having good thermal resistance, good appearance, and good moldability.

Nowhere does *Bastiaens et al.* disclose, or even suggest, that the electrically conductive filler be provided in a discontinuous dispersed phase within a polyamide matrix. To the contrary, all of the methods described by *Bastiaens et al.* for formulating the material suggest to those ordinary skill in the art that the electrically conductive filler should be incorporated into the polyphenylene ether copolymer/polyamide blend. See, e.g., column 15, lines 38-62 of *Bastiaens et al.*

While acknowledging this deficiency, it is nonetheless asserted in the grounds for rejection, that:

It would have been obvious to one of ordinary skill in the polymer processing art at the time the invention was made to masterbatch the two components together since it would be within the level of ordinarily skilled artisan to vary the blending order of the components to yield a predictable result of producing a polyamide blend containing uniformly distributed filler and impact modifier.

This assertion is respectfully traversed.

First, the above-quoted assertion ignores the suggestions of the explicit disclosure of *Bastiaens et al.* which are contrary thereto. Namely, *Bastiaens et al.*

teaches incorporating an electrically conductive filler into a polyamide-containing matrix. By contrast, as evident from the above, claim 23 clearly requires a process which includes the step of "blending at least one impact modifier with at least one electrically conductive filler, so as to obtain a masterbatch." Thus, *Bastiaens et al.* not only fails to disclose or suggest this aspect of the presently claimed invention, it in fact teaches away from it.

Second, it is respectfully submitted that it would not have been obvious to one of ordinary skill in the art to provide the electrically conductive filler in a dispersed phase of impact modifiers as alleged. Applicants respectfully submit that a person skilled in the art would consider, in light of the teachings of *Bastiaens et al.*, that an addition of electrically conductive filler that was not intimately mixed within the polyamide-containing portion of the composition would be undesirable due to an expected loss of conductivity of the polyamide-containing composition. Therefore, for at least this additional reason, it would not have been obvious to one of ordinary skill in the art to have confined the addition of electrically conductive filler to an impact modifier within a phase dispersed within a polyamide matrix, as required by the presently claimed invention.

It is noted that it is alleged on page 6 of the Official Action, with respect to the interpretation of the claim terminology "dispersed phase" it is stated that this term has been interpreted as "encompassing embodiments wherein the filler, impact modifier and polyphenylene ether are merely blended into a larger weight section of polyamide." This interpretation is respectfully traversed as being improper.

The claims are to be interpreted in light of the specification, and the plain and ordinary meaning attributed to them by those of ordinary skill in the art. See, e.g.,

M.P.E.P. §2111.01. It is respectfully submitted that the above-quoted interpretation is both inconsistent with the specification, and contrary to the plate and ordinary meaning there would be attributed to the term by those in the art.

While there is no explicit definition of "dispersed phase" contained in the specification, the specification is quite clear that an interpretation of this phrase that would read on blending filler into a larger weight section of polyamide is precluded. For example, as discussed on lines 28-36 of page 2 of the present specification:

The incorporation of electrically conductive fillers into the phase composed of impact modifiers makes it possible in particular for these fillers to be well dispersed and the polyamide-matrix-based composition. In addition, the incorporation of these fillers into the impact modifier makes it possible to limit sheer-induced structural rupture of the final plastic parts, compared with plastic parts containing only such fillers added directly to the matrix. (Emphasis added)

On page 4, lines 17-21 of the present specification is disclosed that:

Preferably, the dispersed phase comprises at least 90% by weight, more preferably 95% and particularly 100% of the electrically conductive filler of the composition. In this case, a polyamide matrix contains little or no electrically conductive filler.

In addition, reference is made to the comparative example on page 14 of the present specification. In particular, it is disclosed on lines 3-6 of page 14 of the present specification that the comparative example differs from examples of the present invention in that "the conductive filler and the impact modifier are added separately into the polyamide matrix and not in the form of a masterbatch."

In light of the above, and contrary to the assertions contained on page 6 of the Official Action, the Examiner's interpretation of "dispersed phase" is precluded in light of contents of present specification.

With respect to amended claim 23, as noted above, claim 23 requires a process for forming a composition having a thermoplastic matrix consisting of a polyamide, a copolyamide, a blend of polyamides, or a blend of copolyamides. By contrast, *Hagimori et al.* discloses a composition having a thermoplastic matrix formed by a combination of polyphenylene ether alone or in combination with a styrene polymer, in addition to a polyamide component. See, e.g., page 3, lines 3-6 of *Hagimori et al.* Thus, *Hagimori et al.* clearly fails to disclose at least this aspect of newly presented claim 29.

In addition, *Hagimori et al.* clearly suggests that the filler material be combined with the polyamide blend (see, e.g., Table 1, feed 2; page 7, lines 6 and 30-31: "The foregoing polyphenylene ether polyamide blends may further comprise inorganic fillers such as talc, aluminosilicate, mica, carbon black . . . all ingredients fed together either from the first feed opening or the second feed opening were mixed well by a tumbler mixer prior to the feeding.>").

Therefore, as is the case with *Bastiaens et al.*, *Hagimori et al.* also fails to disclose or suggest forming a masterbatch of impact modifier and electrically conductive filler. In fact, the grounds for rejection fail to even allege that *Hagimori et al.* discloses, or suggests, this requirement.

Although the grounds for rejection are couched as alternative grounds under either anticipation or obviousness, the grounds for rejection contains no obviousness rationale whatsoever.

To the extent that the grounds for rejection are based upon the interpretation of "dispersed phase" set forth on page 6 of the Official Action, such an interpretation is improper for at least the same reasons noted above.

The proposed interpretation of "dispersed phase" is also contrary to the plain and ordinary meaning of the term, especially in the context of an impact modified thermoplastic composition. As well known to those of ordinary skill in the art, the composition which is composed of a thermoplastic matrix containing an impact modifier (e.g., elastomer) comprises a microstructure having two distinct phases; namely, a continuous thermoplastic matrix and a discontinuous phase formed by the impact modifier dispersed therein. As evidence of this plain and ordinary meaning of "dispersed phase" in the context of an impact modified thermoplastic, submitted herewith as Exhibit B is an excerpt taken from Gachter et al., "Plastic Additives," 4th edition. In particular, reference is made to Figure 2 in the discussion contained on page 504 thereof.

Further evidence that the proposed interpretation a "dispersed phase" in the context of an impact modified thermoplastic composition is contrary to the plain and ordinary meaning of the term can be gleaned from the disclosure of U.S. Patent No. 5,844,037 to Lundgard et al.:

The term "phase" as used herein does not include materials present in the composition which are not polymers, such as conductive carbon or fillers. (Column 3, lines 5-8)

For at least the reasons above, amended claim 23 is neither disclosed nor suggested by *Bastiaens et al.* Thus, those claims depending therefrom are also distinguishable over *Bastiaens et al.* For at least the same reasons.

Claims 16-22 and 29 stand rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over EP 0 535 955 B1 to Hagimori et al. (hereafter "*Hagimori et al.*") on the grounds set forth in the Official Action.

Thus, for at least the reasons noted above, *Hagimori et al.* fails to disclose or suggest the process set forth in amended claim 23, and any claim depending therefrom.

Claims 16-23 and 27-29 stand rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent Application Publication No. 2003/0134963 to Miyoshi et al. (hereafter "*Miyoshi et al.*") on the grounds set forth in the Official Action.

With respect to amended claim 23, as previously noted herein, claim 23 requires, *inter alia*, a process for forming a composition having "a thermoplastic matrix consisting of a polyamide, a copolyamide, and blend of polyamides, or a blend of copolyamides." By contrast, *Miyoshi et al.* is directed to a composition having a resinous matrix component formed from a mixture of polyamide and a polyphenylene ether, referred to therein as "an alloy". See, e.g., paragraphs [0005] and paragraph [0024] of *Miyoshi et al.* Thus, *Miyoshi et al.* clearly fails to disclose, or even suggest, at least this aspect of claim 23 or any claim depending therefrom.

To the extent that the grounds for rejection are based upon the interpretation of "dispersed phase" set forth on page 6 of the Official Action, such an interpretation is improper for at least the same reasons noted above.

Claims 16-23 and 27-29 stand rejected under 35 U.S.C. §102(e) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 5,844,037 to Lundgard et al. (hereafter "*Lundgard et al.*") on the grounds set forth in paragraph 11 of the Official Action. For at least the reasons noted below, this rejection should be withdrawn.

As evident from the above, amended claim 23 requires a process for forming a composition having a discontinuous phase containing at least one electrical conductive filler dispersed in the thermoplastic matrix.

Lundgard et al. discloses thermoplastic polymer compositions and techniques for forming the same which may include a minor phase containing an electrically conductive filler. However, *Lundgard et al.* fails to disclose that this minor phase is in the form of a discontinuous phase dispersed within a thermoplastic matrix. In fact, *Lundgard et al.* teaches away from such a construction. More specifically, *Lundgard et al.* teaches that the minor phase containing the conductive filler is a continuous phase. See, e.g., column 4, line 64 - column 5, line 5 of *Lundgard et al.*

Thus, *Lundgard et al.* fails to disclose, or even suggest, the process set forth in amended claim 23, or any claim depending therefrom.

To the extent that the grounds for rejection are based upon the interpretation of "dispersed phase" set forth on page 6 of the Official Action, such an interpretation is improper for at least the same reasons noted above.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it

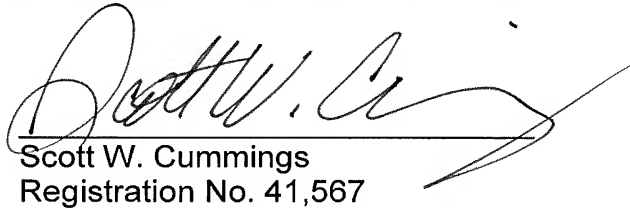
is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

BUCHANAN INGERSOLL & ROONEY PC

Date: July 23, 2009

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EXHIBIT A

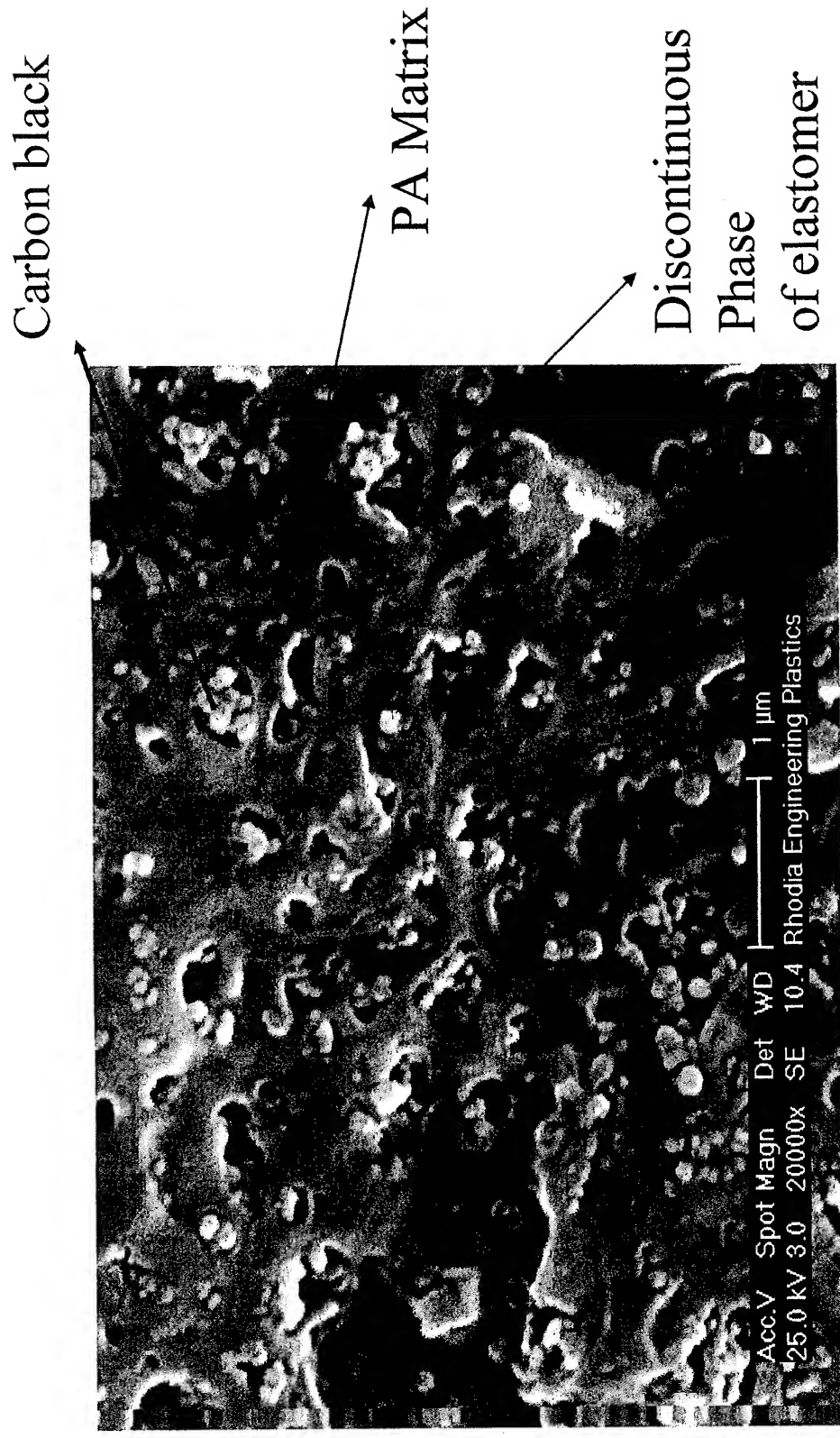


Photo SEM after « etching » of elastomeric phase

EXHIBIT B

Gächter/Müller

Plastics
Additives

4th Edition



Preface to the Fourth Edition

The third edition of the *Plastics Additives Handbook* sold out completely within three years, a very clear indication that this book is needed and appreciated by the plastics community.

Not much has changed during this period in the technology of plastics additives. However, major changes are evident in the market scenario. The publishers thus decided not just to reprint the third edition but to correct errors and update the index of trade names, manufacturers and suppliers. So this fourth edition is actually not a revised edition with major changes but is composed of the text of the third edition with an updated index of suppliers for each group of additives. Our thanks to the authors for their help and advice.

The Editors

Spring 1993

Preface to the first edition

The vigor of the plastics industry remains unbroken but there has been a shift in emphasis with regard to technical development. Today front stage is occupied by the development of plastics and plastics systems, tailor-made for specific applications.

Along with copolymers and physical blends of various plastics, additives are enjoying a key position within this new trend in development. They permit the use of plastics in applications where the plastics material as such would have had small chance of success.

Additives are accepted today as full-fledged partners of plastics. In this sense, this *Additives Handbook* is a logical and long overdue complement to the trade literature. The *Additives Handbook* is a reference book having as objective to summarize the state of the art achieved in this area. Next to this somewhat static point of view, attempts have been made to present an outlook of the future, whenever relevant technical trends could be discerned at this time. It is hoped in this way to stimulate further, in depth collaboration among plastics producers, plastics processors, and additives manufacturers. This in turn should lead to long term meaningful problem solutions, thereby further strengthening the position of plastics materials in technology and the economy in general.

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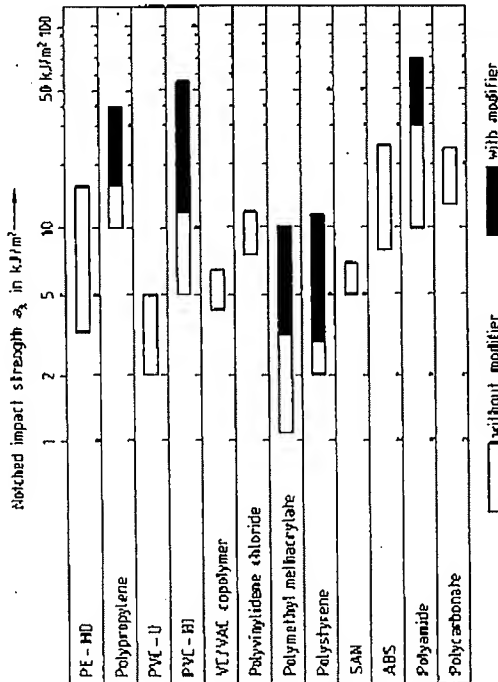


Fig. 1. Impact strength α_k of various polymers at 23 °C (U-notch).

strength of a material be higher than its yield stress. Deformation processes can therefore be initiated and, moreover, the polymer molecules are sufficiently mobile to dissipate the stress inhomogeneities, arising on loading, by means of local flow processes and thus prevent the occurrence or propagation of macroscopic cracks.

To be able to assess both energy components separately, pendulum impact instruments have been fitted with measuring devices which record the force/deformation diagram during the impact test [1].

The temperature ranges in which the macromolecules or molecular segments become mobile and deformation processes are thus possible can be determined from the relaxation processes in the torsion pendulum test (DIN 53445, ISO 537-1980) [2]. Since the temperature of deflection under load (DIN 53461, ISO 75-1987) can also be influenced by addition of high polymers, the determination of the Vicat softening point (DIN 53460, ISO 306-1974) should be additionally included for characterizing impact-modified thermoplastics. The Vicat softening point represents an integral value comprising the degree of softness and flow characteristics of a material [3].

It has long been known to improve the toughness of a hard, brittle thermoplastic by the addition of plasticizers or by copolymerization, which however leads to considerable losses in rigidity. On the other hand, if a polymer mixture (polyblend) of a thermoplastic and an elastomer is produced, i.e. a multiphase system comprising two substantially mutually incompatible polymers, toughness can be drastically increased without perceptibly diminishing rigidity [4].

Since the measures for improving the impact strength are different depending on the plastic, the relevant polymers are discussed individually.

8.2 Theory of impact strength improvement

The term modifier, which has been introduced for high-polymeric additives for the selective improvement of the application properties of thermoplastics, is not a uniquely defined designation (c.f. chapter 7: High-polymeric processing aids for PVC). In this chapter this term is, of course, understood to mean those additives which convert an intrinsically brittle plastic to one with high toughness.

The structure of polymer mixtures - polyblends - is based on the simple idea of combining polymers having different properties in such a way that new plastics having a wider spectrum of applications result from them. In the present case, improvement is sought principally of the impact strength of a thermoplastic by the addition of high-polymeric additives. Since polymers are mutually compatible at the molecular level only in exceptional cases, as a rule, multiphase systems are obtained by mixing and the existence of more than one phase (c.f. figure 2) is a typical feature of polyblends [4].

Very thorough work has been carried out on the fundamentals of mixing polymers and on the morphology of polyblends particularly in recent years. The industry has learned how the supposed disadvantage of the existence of more than one phase can be transformed into an advantage when developing a material, by producing the blends in the correct manner. By virtue of the existence of more than one phase, additional parameters are created, which open up the possibility of developing new materials with improved properties.

For thermoplastics which have been rendered impact resistant the basic prerequisite in accordance with the comments so far made is:

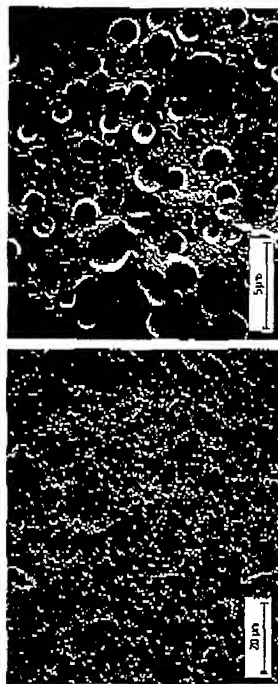


Fig. 2. Morphology of a blend of polybutylene terephthalate and EPDM.

- A multiphase structure as a consequence of the incompatibility between a "hard" thermoplastic phase and a "soft" component, the elastomeric phase.

When final articles made from impact-modified polymers are subjected to shock and impact stress the mechanical energy imparted is initially absorbed by the coherent matrix, the hard phase. If brittle fracture is to be prevented, the energy must be transferred, being diverted to the enclosed elastomeric phase [5]. If this transfer is not possible, the energy absorbed remains in the continuous hard phase and can lead to the build-up of stress peaks at unfavorable locations, which initiate fracture.

Investigations of the structure of impact resistant polyblends formed in different ways have revealed two types of blends which differ fundamentally from each other in their structures and accordingly in their fracture mechanisms [3, 5, 6].

- Systems with an elastomeric phase distributed as a honey-combed network (e.g. PVC/EVA, PVC/PE-C),
- systems with spherical elastomeric particles, which are dispersed in a hard polymer matrix (e.g. PVC/PAE, PVC/ABS, PVC/MBS).

In these systems good adhesion must exist at the phase boundary, since this is subjected to stresses of various origin.

Since the matrix, the hard phase, and the elastomeric phase have unequal thermal coefficients of expansion, shrinkage stresses occur in the rubber

particles on cooling after processing (so-called internal stresses). Above the glass transition temperature (T_g) of the matrix the coefficients of expansion of both phases are approximately equal, while below T_g the coefficient of expansion of the matrix becomes smaller and that of the elastomer remains essentially unchanged. Therefore, on cooling the rubber has more pronounced shrinkage than the matrix, whereby tensile stresses are generated between the matrix and the elastomeric particles [7].

To ensure a large excess stress, the matrix must have low elasticity, i.e. a high modulus of elasticity, which harmonizes with the requirement for a large difference in modulus between the elastomeric phase and the matrix [5].

For polymers, the following molecular processes are taken as the basis [5, 8] for the dissipation of energy under the influence of shock and impact effects.

- *Craze formation* (fibrillated deformation zones): dissipation of energy by the formation of microscopic voids by stretching processes resulting in increased volume (figure 3),
- *shear deformation* (shear yielding): dissipation of energy by slip processes of the polymer chains of the matrix without significant change in volume (figure 4).

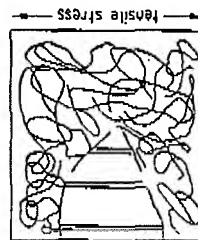


Fig. 3. Craze formation (volume increase).



Fig. 4. Shear deformation (volume unchanged).

In impact-modified polystyrene the energy is dissipated by craze formation, while PVC and polycarbonate show predominantly shear yielding. With polyoxymethylene and polymethyl methacrylate both phenomena are observed.